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(56) Documents cited
US 4414128

(58) Field of search

**C5D
Selected US specifications from IPC sub-class C11D**

(54) **Hard surface cleaning composition**

(57) Compositions for cleaning hard surfaces, requiring no rinsing, comprise a low boiling solvent (e.g. isopropanol), a high boiling solvent (benzyl alcohol), a surfactant, a fugitive alkaline material and water.

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SPECIFICATION

No-rinse hard surface cleaning composition

5 *Field of the invention*

The invention pertains to aqueous compositions for cleaning hard surfaces, especially glossy surfaces such as glass and tile. The compositions leave only an insubstantial amount of film on the surface, thereby eliminating the need for rinsing.

10 *Background of the invention*

U.S. Pat. No 3,463,735, issued August 26, 1969, to Stonebreaker et al., discloses aqueous cleaning compositions for glossy surfaces (especially glass), which contain a low boiling solvent (e.g., isopropanol), a high boiling solvent (e.g., a glycol or glycol ether) a surfactant (e.g., an alkarylsulfonate), an alkali metal polyphosphate and ammonia.

15 U.S. Pat. No. 4,414,128, issued November 8, 1983, to Goffinet, discloses aqueous hard surface cleaning compositions which contain 1% to 20% surfactant (e.g., an alkarylsulfonate), 0.5% to 10% of a polar solvent, which can be benzyl alcohol, and 0.5 to 10% of a terpene solvent. Additional solvents such as isopropanol, and alkaline materials such as ammonium carbonate can also be present.

The present invention relates to compositions for cleaning glossy surfaces which are superior to the compositions of Stonebreaker et al.

Summary of the invention

The present invention is directed to aqueous no-rinse hard surface cleaning compositions, especially suitable for use in a no-rinse mode on glossy surfaces, which compositions contain an anionic, nonionic, amphoteric or zwitterionic surfactant, a lower aliphatic monohydric alcohol, benzyl alcohol, and a fugitive alkaline material, such as ammonia.

Detailed description of the invention

In accordance with the present invention, it has been found that improved performance over compositions of the type described in U.S. Pat. No. 3,463,735 can be achieved by use of benzyl alcohol instead of glycols or glycol ethers as the high boiling solvent in such compositions.

The compositions of the present invention comprise:

(a) from about 1% to about 10% of at least one lower aliphatic monohydric alcohol having a boiling point within the range of from about 75°C to about 100°C;

35 (b) from about 1% to about 10% benzyl alcohol;

(c) from about 0.08% to about 2.5% of an anionic, nonionic, amphoteric or zwitterionic surfactant;

(d) from about 0.05% to about 2% of a fugitive alkaline material; and the balance being water.

All proportions and ratios herein are "by weight" unless specified otherwise.

The lower aliphatic alcohols which are suitable for use in the compositions of the present invention are those having from 2-4 carbon atoms and having a boiling point within the range of about 75°C to about 100°C. Examples of these are isopropyl alcohol, n-propyl alcohol, ethyl alcohol, sec-butyl alcohol, tert-butyl alcohol, and mixtures thereof. Lower aliphatic alcohols which do not possess the requisite boiling points are not suitable for use herein in that, those having a boiling point below 75°C tend to evaporate too quickly to impart the desired effects, while those having boiling points in excess of 100°C tend to evaporate too slowly.

45 A particularly suitable lower aliphatic alcohol is isopropyl alcohol which has a boiling point of about 82.3°C.

These lower aliphatic alcohols may be present in amounts which vary from about 1% to about 10%. If less than 1% is used the desired effect of this ingredient, the tendency to increase the volatility of the total composition, will not be noticed, while using amounts in excess of about 10% will have a deleterious effect on the performance of the surfactants present. Amounts of this ingredient which are particularly suitable, and therefore preferable for use herein, are from about 2.0% to about 5%.

50 The high boiling solvent used in the present compositions is benzyl alcohol (B.P. 205°C). This material provides excellent cleaning performance and also provides lubricity for spreading the composition on the surface to be cleaned. Its tendency to cause filming/streaking on surfaces is sufficiently low to be acceptable in a product formulated for "no-rinse" usage. Benzyl alcohol is used in the compositions herein at a level of from about 1% to about 10%, preferably from about 1.0% to about 2.5%.

55 Use of a combination of the organic solvents enumerated above, the lower aliphatic alcohol having a relatively low boiling point and the benzyl alcohol having a relatively higher boiling point, is required in compositions of the instant type which are formulated to be used in a no-rinse mode. The combination of solvents in their respective concentrations will provide a sufficiently slow evaporation rate to promote easy spreading without rendering the evaporation rate so slow as to require excessive mopping for removal of these compositions.

60 Preferably, the compositions herein are substantially free of organic solvents other than the lower alcohols with boiling points of 75°C to 100°C and benzyl alcohol, as described above. In particular, the compositions herein are substantially free of terpenes, which are an essential component of the compositions of U.S. Pat. No. 4,414,128, issued to Goffinet, November 8, 1983.

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The synthetic detergents for the present compositions can be selected from the anionic, nonionic, amphoteric and zwitterionic types of hydrocarbon surfactants. Such detergents are well known to those skilled in the detergency art.

The most common type of anionic synthetic detergents can be broadly described as the water-soluble salts, particularly the alkali metal salts, of organic sulfuric reaction products having in the molecular structure an alkyl radical containing from about 8 to about 22 carbon atoms and a radical selected from the group consisting of sulfonic acid and sulfuric acid ester radicals. Important examples of these synthetic detergents are the sodium, ammonium or potassium alkyl sulfates, especially those obtained by sulfating the higher alcohols produced by reducing the glycerides of tallow or coconut oil; sodium or potassium alkyl benzene sulfonates, in which the alkyl group contains from about 9 to about 15 carbon atoms, especially those of the types described in U.S. Pat. Nos. 2,220,099 and 2,477,383, incorporated herein by reference; sodium alkyl glyceryl ether sulfonates, especially those ethers of the higher alcohols derived from tallow and coconut oil; sodium coconut oil fatty acid monoglyceride sulfates and sulfonates; sodium or potassium salts of sulfuric acid esters of the reaction product of one mole of a higher fatty alcohol (e.g., tallow or coconut oil alcohols) and about three moles of ethylene oxide; sodium, potassium or ammonium salts of alkyl phenol ethylene oxide ether sulfates with about four units of ethylene oxide per molecule and in which the alkyl radicals contain about 9 carbon atoms; the reaction product of fatty acids esterified with isethionic acid and neutralized with sodium hydroxide where, for example, the fatty acids are derived from coconut oil; sodium or potassium salts of the fatty acid amide of a methyl taurine in which the fatty acids, for example, are derived from coconut oil; and others known in the art, a number being specifically set forth in U.S. Pat. Nos. 2,486,921, 2,486,022 and 2,396,278, incorporated herein by reference.

Nonionic synthetic detergents comprise a class of compounds which may be broadly defined as compounds produced by the condensation of alkylene oxide groups (hydrophilic in nature) with an organic hydrophobic compound, which may be aliphatic or alkyl aromatic in nature. The length of the hydrophilic or polyoxyalkylene radical which is condensed with any particular hydrophobic group can be readily adjusted to yield a water-soluble compound having the desired degree of balance between hydrophilic and hydrophobic elements.

For example, a well-known class of nonionic synthetic detergents is made available on the market under the trade name of "Pluronic". These compounds are formed by condensing ethylene oxide with an hydrophobic base formed by the condensation of propylene oxide with propylene glycol. The hydrophobic portion of the molecule which, of course, exhibits water-insolubility has a molecular weight of from about 1500 to 1800. The addition of polyoxyethylene radicals to this hydrophobic portion tends to increase the water-solubility of the molecule as a whole and the liquid character of the products is retained up to the point where polyoxyethylene content is about 50% of the total weight of the condensation product.

Other suitable nonionic synthetic detergents include:

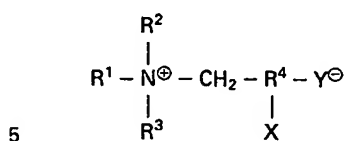
(i) The polyethylene oxide condensates of alkyl phenols, e.g., the condensation products of alkyl phenols having an alkyl group containing from about 6 to 12 carbon atoms in either a straight chain or branched chain configuration, with ethylene oxide, the said ethylene oxide being present in amounts equal to 10 to 25 moles of ethylene oxide per mole of alkyl phenol. The alkyl substituent in such compounds may be derived from polymerized propylene, diisobutylene, octane, or nonane, for example.

(ii) Those derived from the condensation of ethylene oxide with the product resulting from the reaction of propylene oxide and ethylene diamine — products which may be varied in composition depending upon the balance between the hydrophobic and hydrophilic elements which is desired. Examples are compounds containing from about 40% to about 80% polyoxyethylene by weight and having a molecular weight of from about 5000 to about 11,000 resulting from the reaction of ethylene oxide groups with a hydrophobic base constituted of the reaction product of ethylene diamine and excess propylene oxide, said base having a molecular weight of the order of 2500 to 3000, are satisfactory.

(iii) The condensation product of aliphatic alcohols having from 8 to 18 carbon atoms, in either straight chain or branched chain configuration, with ethylene oxide, e.g., a coconut alcohol ethylene oxide condensate having from 10 to 30 moles of ethylene oxide per mole of coconut alcohol, the coconut alcohol fraction having from 10 to 14 carbon atoms.

(iv) Trialkyl amine oxides and trialkyl phosphine oxides wherein one alkyl group ranges from 10 to 18 carbon atoms and two alkyl groups range from 1 to 3 carbon atoms; the alkyl groups can contain hydroxy substituents; specific examples are dodecyl di(2-hydroxyethyl) amine oxide and tetradecyl dimethyl phosphine oxide.

Zwitterionic detergents comprise the betaine and betaine-like detergents wherein the molecule contains both basic and acidic groups which form an inner salt giving the molecule both cationic and anionic hydrophilic groups over a broad range of pH values. Some common examples of these detergents are described in U.S. Pat. Nos. 2,082,275, 2,702,279 and 2,255,082, incorporated herein by reference. Suitable zwitterionic detergent compounds have the formula



wherein R¹ is an alkyl radical containing from about 8 to about 22 carbon atoms, R² and R³ contain from 1 to about 3 carbon atoms, R⁴ is an alkylene chain containing from 1 to about 3 carbon atoms, X is selected from the group consisting of hydrogen and a hydroxyl radical, Y is selected from the group consisting of carboxyl and sulfonyl radicals and wherein the sum of the R¹, R² and R³ radicals is from about 14 to about 24 carbon atoms.

Amphoteric detergents which can be either cationic or anionic depending upon the pH of the system are represented by detergents such as dodecyl-beta-alanine, N-alkyltaurines such as the one prepared by reacting dodecylamine with sodium isethionate according to the teaching of U.S. Pat. No. 2,658,072, N-higher alkylaspartic acids such as those produced according to the teaching of U.S. Pat. No. 2,438,091, and the products sold under the trade name "Miranol", and described in U.S. Pat. No. 2,528,378, said patents being incorporated herein by reference.

Additional synthetic detergents and listings of their commercial sources can be found in *McCutcheon's Detergents and Emulsifiers*, North American Ed. 1980, incorporated herein by reference.

Preferred synthetic surfactants for use in the compositions herein are selected from the group of linear primary alcohol ethoxylates, such as the reaction product of a linear primary alcohol having from about 10 to about 14 carbon atoms reacted with an average of from about 2 to about 6 moles of ethylene oxide; the alkyl aryl sulfonates having from about 11 to about 13 carbon atoms in the alkyl chain; sulfates of C₁₀ to C₁₄ fatty alcohols, e.g., sodium lauryl sulfate; C₈ to C₁₂ alkyl phenoxy polyethoxy ethanol e.g., octyl phenol condensed with 3 to 10 moles of ethylene oxide. A particularly preferred surfactant for use herein is sodium lauryl sulfate.

The amount of synthetic surfactant present in the instant compositions can vary from about 0.08% to about 2.5%. A particularly suitable amount for use herein is from about 0.1% to about 0.3%. Fugitive alkaline materials are used in the compositions herein for their ability to improve detergency without increasing the level of nonvolatile ingredients, since these materials will evaporate from the surface being cleaned. Examples of suitable fugitive alkaline materials are ammonia and morpholine. The amount of fugitive alkaline material which is useful herein can vary from about 0.05% to about 2%. Using less than about 0.05% will affect the ability of the formulation to remove greasy soils while using more than about 2% will result in the liberation of gases, which create an offensive odor. Although morpholine can be used herein it is preferable to use ammonia. When ammonia is used it may be conveniently added in the form of ammonium hydroxide, ammonium acetate and ammonium carbonate, however, if so added it should be added in quantities capable of producing suitable amounts of ammonia. A particularly suitable amount of the fugitive alkaline material for use herein is from about 0.1% to about 1%.

The last of the essential ingredients is water which will make up the balance of the composition. In order to achieve a composition with a low concentration of nonvolatile ingredients, it has been found that the aqueous component should preferably be made up of deionized or soft water.

In addition to the synthetic surfactants noted above, the compositions herein can optionally contain a second surfactant which is a fluorinated hydrocarbon surfactant.

Fluorinated hydrocarbon surfactants are structurally analogous to the synthetic surfactants described above, except that in fluorinated hydrocarbon surfactants some or all of the hydrogen atoms in the surfactant hydrocarbon chain are replaced with fluorine atoms.

Many examples of fluorocarbon surfactants are known to the art. The following are given by way of illustration:

(a) Anionics
R_fCH₂CH₂SCH₂CO₂M wherein R_f is F(CF₂CF₂)_n wherein n is from about 3 to about 8 and M is alkali metal (e.g., sodium or potassium) or ammonium.

C_nF_{2n+1}CO₂M wherein C_nF_{2n+1} is a straight chain fluorocarbon radical, M is an alkali metal or ammonium and n is from about 4 to about 12.

C_nF_{2n+1}SO₃M wherein C_nF_{2n+1} is a straight chain fluorocarbon radical, n is from about 8 to about 12 and M is alkali metal or ammonium.

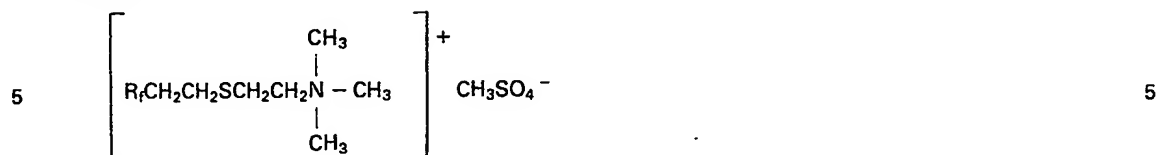
C_nF_{2n-1}OC₆H₄SO₃M wherein C_nF_{2n-1} is a branched chain fluorocarbon radical, n is from about 8 to about 12 and M is alkali metal or ammonium.

(b) Nonionics
R_fCH₂CH₂O(CH₂CH₂O)_xH wherein R_f is a straight chain F(CF₂CF₂)_n radical, wherein n is from about 3 to about 8.

R_f(OCH₂CH₂)_nOR wherein R_f is a branched chain radical of the formula C₈F₁₅, C₁₀H₁₉ or C₁₂F₂₃ and n is from about 10 to about 30.

R_f(OCH₂CH₂)_mOR wherein R_f is a branched chain radical of the formula C₈F₁₅, C₁₀H₁₉ or C₁₂F₂₃, m is from about 2 to about 20 and R is C₁ to C₃ alkyl.

(c) Cationic



wherein R_f is $\text{F}(\text{CF}_2\text{CF}_2)_n$ in which n is 3 to 8.

10 Fluorinated hydrocarbon surfactants are available from numerous commercial sources as trademarked products. Examples are ZONYL[®] Fluorosurfactants from E. I. duPont de Nemours & Co., FLUORAD[®] Fluorochemical Surfactants from 3M Company, e.g. FLUORAD FC129, and MONOFLO[®] fluorocarbon surfactants from I.C.I., Ltd.

15 Particularly preferred fluorinated hydrocarbon surfactants for use herein are those of the formula $\text{C}_n\text{F}_{2n+1}\text{CO}_2\text{M}$ wherein n is from about 6 to about 12, most preferably about 8.

These fluorinated hydrocarbon surfactants, if used in the compositions herein, can be present in amounts which range from about 0.003% to about 2%. A particularly suitable amount of the fluorinated hydrocarbon surfactant is from about 0.01% to about 0.08%.

20 Optionally, alkali metal pyrophosphates or other chelating agents such as nitrilotriacetic acid or ethylenediaminetetraacetic acid may also be included in the compositions herein at levels of from about 0.02% to about 2.00% to further improve cleaning performance. However, since these materials are nonvolatile, their use in the compositions entails some sacrifice in freedom from filming and streaking on glossy surfaces.

Other optional ingredients include perfumes and dyes.

25 The compositions can be made by mixing the various ingredients in any of the suitable amounts previously set forth herein. In use, the compositions are applied to a surface in any conventional manner such as spraying, pouring, etc. After being left in contact with the surface the composition is removed by wiping the surface with a clean, dry, absorbent material. After removal of the composition, the surface is clean and does not require rinsing. Due to the high content of volatile ingredients in the instant 30 compositions, any film or residue left on the surface is minimal. Thus the surface is maintained in a glossy condition. Also, tendency for resoiling is reduced since there is virtually no residue for airborne dust, etc., to adhere to.

The invention will be illustrated by the following examples.

35 *Example 1*
A composition of the invention (A) and a similar composition in which benzyl alcohol was replaced by ethyleneglycol monobutyl ether were prepared according to the following formulas:

TABLE 1

		% By Weight	
		A	B
45	Isopropanol	4.0	4.0
	Benzyl alcohol	1.75	---
	Ethyleneglycol monobutyl ether	---	1.75
	Sodium lauryl sulfate	0.1	0.1
	Fluorinated hydrocarbon surfactant	0.01	0.01
50	(100% active basis)*		
	Ammonia (calculated as NH_3)	0.17	0.17
	Distilled water	to 100	to 100
55	*50% solution of $\text{C}_n\text{F}_{2n+1}\text{CO}_2\text{K}$ in ethanol, 2-butoxyethanol and water, wherein n is primarily 8.		

The compositions were tested for cleaning performance on greasy soil according to the following test method.

60 *Greasy soil removal test method*

A light, even coating of tough greasy soil (a combination of various greases and particulates), like that typically found in the kitchen, was applied on clean 7.6 by 34.1 cm cooking range splash plates, using a 0.6 cm nap paint roller, and cured by heating in an oven for 3 hours at 140°C followed by storage at room temperature for at least 24 hours. A measured quantity (0.8 ml) of the composition was applied via syringe

65 and lightly spread with a finger over the cleaning area (approx. 7.6 cm by 5 cm) and allowed to remain there

for 30 seconds prior to cleaning. The area was then cleaned using a Gardner straight line washability machine, using six strokes. Percent removal of soil was then estimated by visual observation. Two replicates were done for each composition.

Results were as follows:

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TABLE 2

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Greasy soil cleaning - % removal

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Composition Replicate

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A 1 65%

A 2 70%

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B 1 30%

B 2 25%

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20 From these results it is seen that the composition of the invention, containing benzyl alcohol is superior in cleaning performance compared to a similar composition containing ethyleneglycol monobutyl ether as the high boiling solvent.

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CLAIMS

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1. A cleaning composition for hard surfaces consisting essentially by weight of:

(a) from about 1% to about 10% of at least one organic solvent which is a lower aliphatic monohydric alcohol having from about 2 to about 4 carbon atoms and having a boiling point within the range of from about 75°C to about 100°C;

30 (b) from about 1% to about 10% benzyl alcohol;

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(c) from about 0.08% to about 2.5% of a synthetic detergent selected from the group consisting of anionic, nonionic, amphoteric, ampholytic and zwitterionic hydrocarbon surfactants;

(d) from about 0.05% to about 2% of a fugitive alkaline material which can be ammonia, or morpholine; and

35 (e) the balance of said composition being water.

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2. The composition of Claim 1 wherein Component (a) is present at from about 2.0% to about 5%, Component (b) is present at from about 1.0% to about 2.5%, Component (c) is present at from about 0.1% to about 0.3%, and Component (d) is present at from about 0.01% to about 1%.

3. The composition of Claim 2 wherein Component (c) is selected from the group consisting of

40 ethoxylates of linear primary alcohols containing from about 10 to about 14 carbon atoms in the alkyl chain, alkaryl sulfonates containing from about 11 to about 13 carbon atoms in the alkyl chain, sulfates of C₁₀ to C₁₄ fatty alcohols, and phenoxy polyethoxy ethanol.

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4. The composition of Claim 3 containing as an additional surfactant, Component (f) a fluorinated hydrocarbon surfactant selected from the group consisting of:

45 i. C_nF_{2n+1}CO₂M wherein C_nF_{2n+1} is a straight chain fluorocarbon radical, n is from about 8 to about 12 and wherein M is an alkali metal or ammonium;

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ii. R_fCH₂CH₂SCH₂CO₂M wherein R_f is F(CF₂CF₂)_n in which n is from about 3 to about 8 and wherein M alkali metal or ammonium;

iii. C_nF_{2n+1}SO₃M wherein C_nF_{2n+1} is a straight chain fluorocarbon radical in which n is from about 8 to about 12 and wherein M is alkali metal or ammonium;

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iv. C_nF_{2n-1}OC₆H₄SO₃M in which C_nF_{2n-1} is a branched chain fluorocarbon radical and wherein M is alkali metal or ammonium;

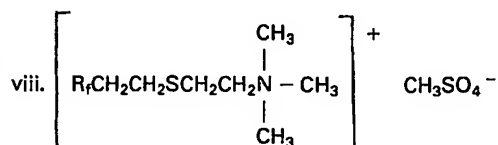
v. R_fCH₂CH₂O(CH₂CH₂O)_xH wherein R_f is a F(CF₂CF₂)_n radical, wherein n is from about 3 to about 8;

vi. R_f(OCH₂CH₂)_nOR_f wherein R_f is a branched chain radical of the formula C₈F₁₅, C₁₀H₁₉ or C₁₂F₂₃ and n is from about 10 to about 30;

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vii. R_f(OCH₂CH₂)_mOR wherein R_f is a branched chain radical of the formula C₈F₁₅, C₁₀H₁₉ or C₁₂F₂₃, m is from about 2 to about 20 and R is C₁ to C₃ alkyl; and

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wherein R_f is $F(CF_2CF_2)_n$ in which n is from about 3 to about 8, the amount of Component (f) in said composition being from about 0.008% to about 2%.

5. The composition of Claim 3 wherein Component (a) is isopropanol Component (c) is the sulfate of a C_{10} to C_{14} alcohol and Component (e) is ammonia.

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